



**Centre of Excellence - Innovation  
Operational and Technical Excellence**

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# **The Mine of the Future - a Rio Tinto Vision**

## **Invisible Mining?**

*Chris Cross*

*Society of Mining Professors, Research, Kosice, 18 June 2006*

**RIO  
TINTO**

# Rio Tinto operations



# Rio Tinto business units





# Rio Tinto vision and strategy

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## Vision:

- High safety, efficiency and sustainable development targets
- Large, long life, low cost and largely **underground** mining operations

## Thus strategy is

- Improve efficiency
- Reduce waste
- Ensure greater reliability and predictability
- Promote what is ethical, not just what is expedient
- Foster innovation - improvements through technology
- Lead, not react



# Mine of the future characteristics

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Sustainable, minimum impact and economic

- Limited use of land and surface disturbance during mining
- Easy return of land to sustainable and beneficial use
- Safe conditions for employees and neighbours
- Low risks of incidents and emergencies
- Near zero impact on quality and available quantity of other natural resources
- Activities consistent with development plans and targets

## Invisible mining?

# Technical challenges

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- Efficient use of limited resources - water, power, people
- Lower grade, less accessible deposits or technically difficult mineralogies
- Rapid underground infrastructure construction
- Automation and communication systems
- Material transport systems – hydraulic lift?
- Mining method
- Orebody to mill to metal system integration and optimization

**Innovation needed**

# Barriers to the future

## ● *Lack of innovation*

Collaborative research required between industry, suppliers and universities (*universities tend to be the idea generators*)

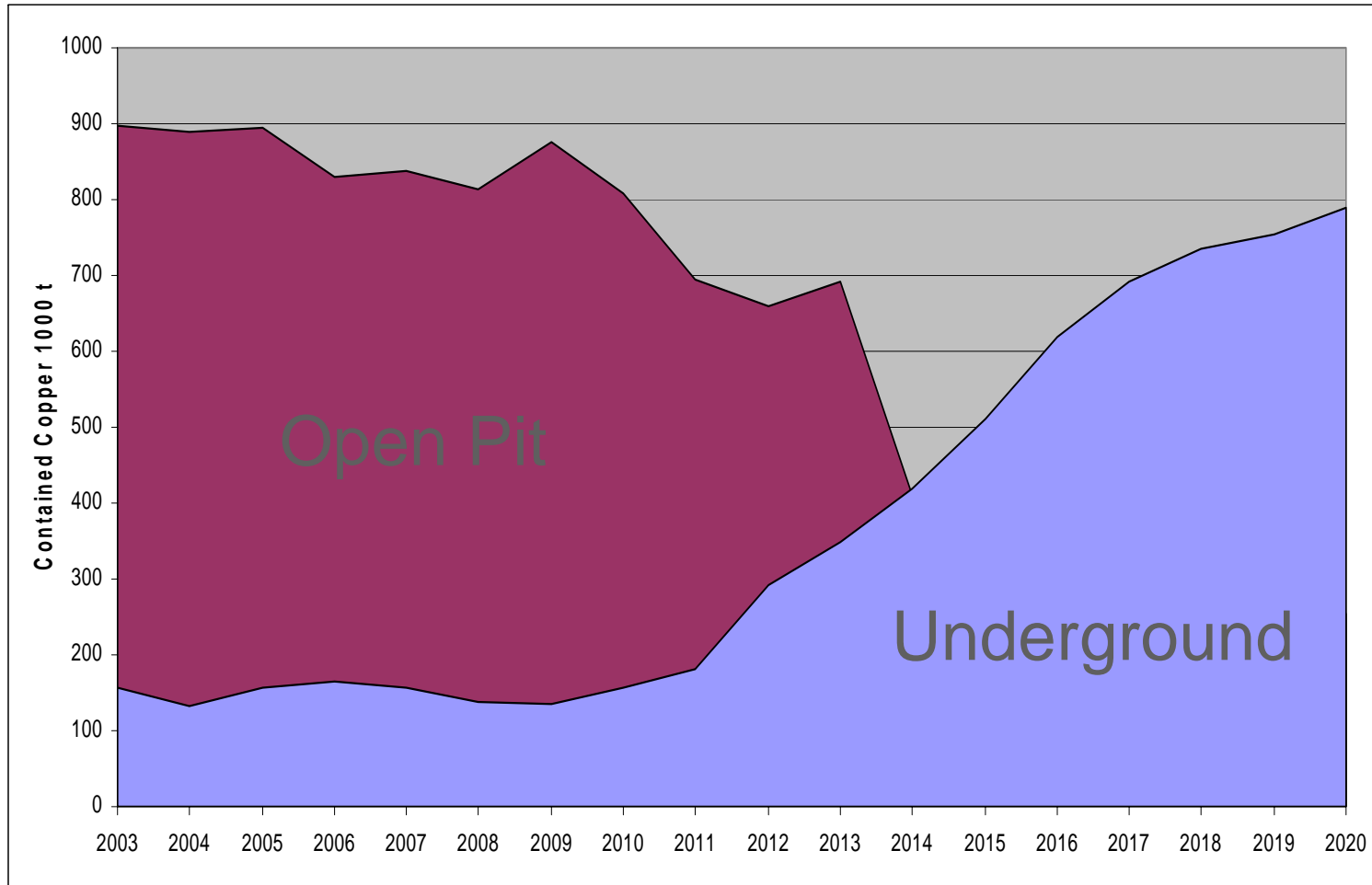
## ● *Shortage of staff*

There is a world shortage of mining, geotechnical and metallurgical graduates due to lack of interest by young people and the consequent closure of courses

At the same time the industry is expanding whilst its ageing work force is retiring (*again the universities are the key*)

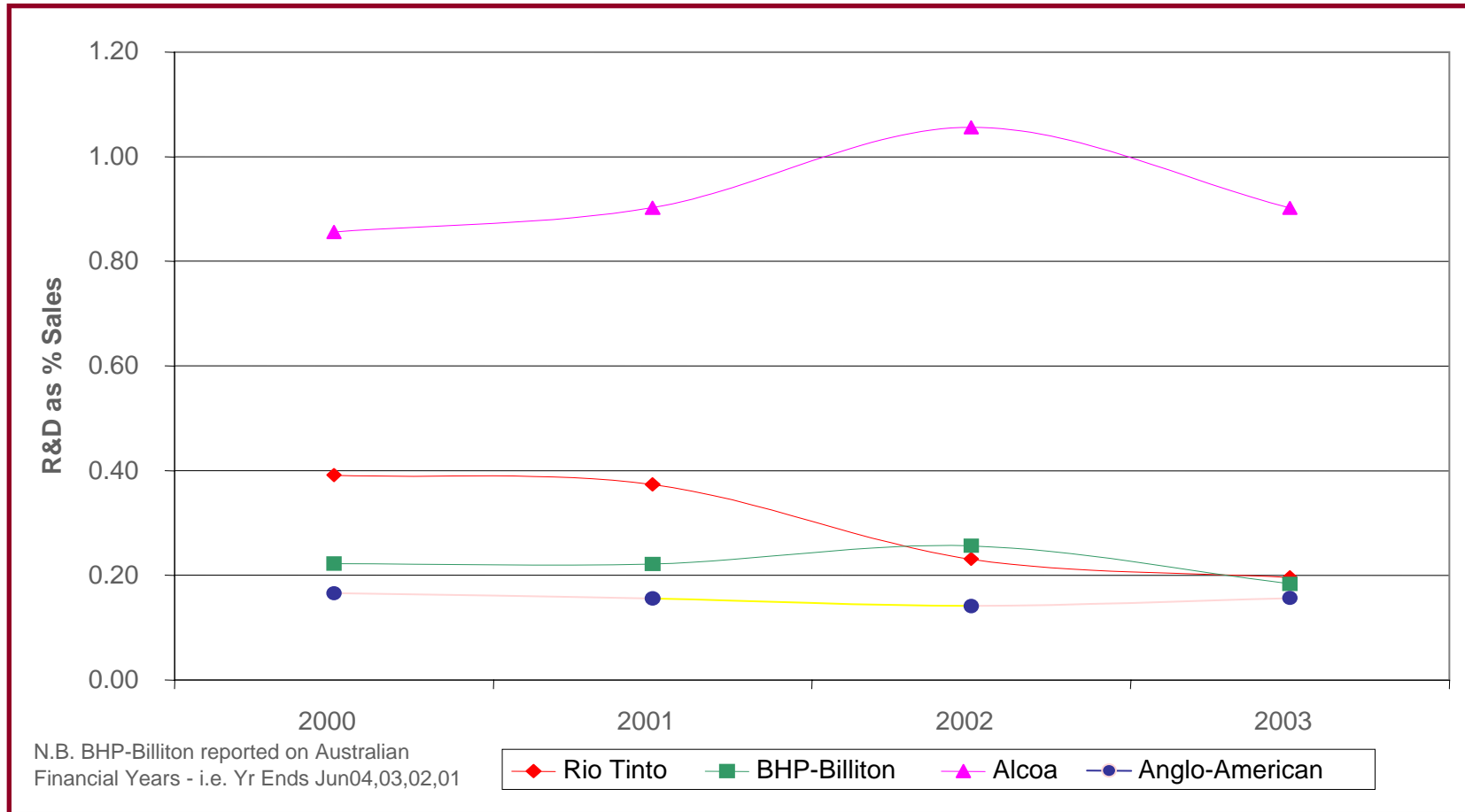
# Rio Tinto Copper output

## Rio Tinto Production Share

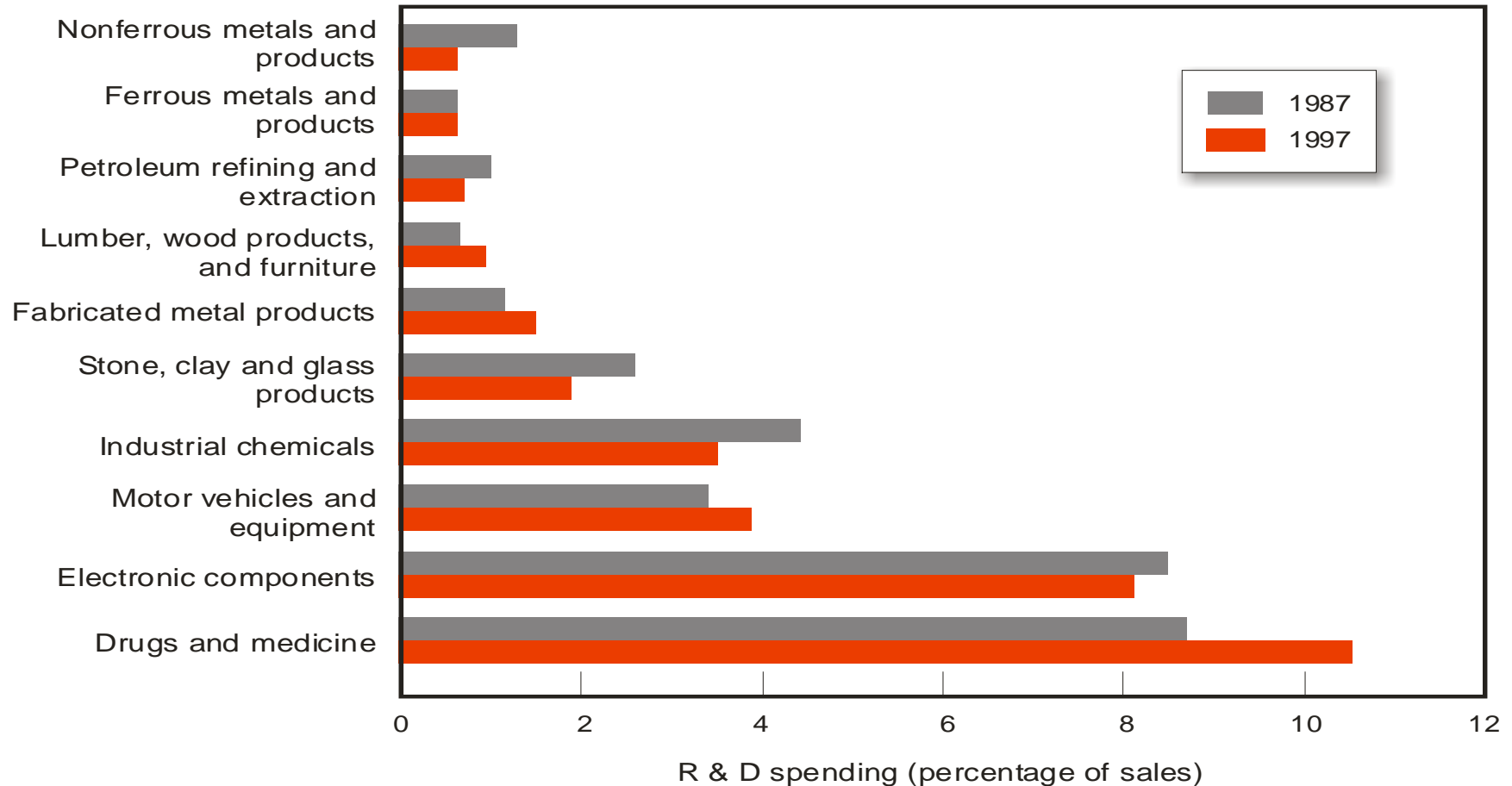


# ...Mining industry R&D investment

## R&D as a percentage of sales



# Comparative investment in R&D



Source: National Science Board, *Science and Engineering Indicators 2000*, Arlington, VA: National Science Foundation, 2000 (NBS-00-1).



# Innovation, what industry can do?

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- Devote more of turnover to research
- Look to the universities and research centres for ideas
- Look for step-change technology
- Take more risks on new technology
- Invest in collaborative research with universities, research centres and suppliers to build world-leading teams and share risk of the new



# Rio Tinto research style

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- In-house

- Product related e.g. industrial minerals
- Process development, often at an operation with OTX and external partners

- External

- Global programme identifies centres of excellence
- Match with research strategy
- Establish direct relationship with such centres
- Collaborative research to form best team
- Use of collaborative research brokers e.g. AMIRA, MIRO, CAMIRO, INAP in general, pre-competitive research



# Mine of the future

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- Economic evaluation, mine design, operation and closure treated in a completely integrated manner, taking into account local community and ecology before, during and after mining.
- Underground mining and processing with limited use of land and minimal surface disturbance
- Mining will be on a very large scale at high rates using techniques, such as block caving and automation, with high levels of technology
- Efficient use of energy with high extraction efficiencies of minerals
- Water use will be minimised – recycling, minimisation of losses, development of dry concentration, dry containment
- Operation will be safe for employees and neighbours.
- Low to zero impact on other natural resources
- The mine site will be easy to return to sustainable and beneficial use

## **INVISIBLE MINING**